WHAT IS CLAIMED IS:

1. An optical communications system for communicating an information signal comprising:

a receiver for recovering an information signal from an optical signal containing the information signal, the receiver comprising:

a heterodyne detector for mixing an optical local oscillator signal with an optical signal including at least one tone and a first sideband of the information signal, to produce an electrical signal which is a frequency down-shifted version of the optical signal; and

a signal extractor coupled to the heterodyne detector for mixing the first sideband of the electrical signal with one of the tones of the electrical signal to produce a first component containing the information signal.

2. The optical communications system of claim 1 wherein the heterodyne detector comprises:

an optical combiner for combining the optical local oscillator signal and the optical signal; and

a square law detector disposed to receive the combined optical local oscillator signal and optical signal.

3. The optical communications system of claim 2 wherein the heterodyne detector further comprises:

a polarization controller coupled to the optical combiner for matching a polarization of the optical local oscillator signal with a polarization of the optical signal.

4. The optical communications system of claim 1 wherein the signal extractor comprises:

a first frequency filter for selecting the first sideband and one of the tones from the electrical signal;

a square law device coupled to the first frequency filter for squaring the frequency selected first sideband and tone to produce the first component; and

a second frequency filter coupled to the square law device for selecting the first component.

5. The optical communications system of claim 1 wherein the signal extractor comprises:

a first frequency filter for selecting the first sideband from the electrical signal;

a second frequency filter for selecting one of the tones from the electrical signal;

a multiplier coupled to the first and second frequency filters for multiplying the selected first sideband with the selected tone to produce the first component; and

a third frequency filter coupled to the multiplier for selecting the first component.

6. The optical communications system of claim 1 wherein:

the optical signal further includes a second sideband of the information signal; and

the signal extractor comprises:

a first extraction path for mixing the first sideband of the electrical signal with one of the tones of the electrical signal to produce the first component;

a second extraction path for mixing the second sideband of the electrical signal with one of the tones of the electrical signal to produce a second component; and

a combiner for constructively combining the first and second components to produce a resultant component containing the information signal.

7. The optical communications system of claim 6 wherein the first extraction path overlaps with the second extraction path.

8. The optical communications system of claim 6 wherein each of the first and second extraction paths comprises:

a first frequency filter for selecting the relevant sideband and tone from the electrical signal;

a square law receiver coupled to the first frequency filter for squaring the frequency selected sideband and tone to produce the component; and

a second frequency filter coupled to the square law receiver for selecting the component.

9. The optical communications system of claim 6 wherein each of the first and second extraction paths comprises:

a first frequency filter for selecting the relevant sideband from the electrical signal;

a second frequency filter for selecting the relevant tone from the electrical signal;

a multiplier coupled to the first and second frequency filters for multiplying the selected sideband with the selected tone to produce a component; and

a third frequency filter coupled to the multiplier for selecting the component.

10. The optical communications system of claim 6 wherein the combiner comprises:

a phase shifter coupled to the first extraction path for phase-shifting the first component to be in-phase with the second component; and

an adder for adding the phase-shifted first component and the second component.

11. The optical communications system of claim 1 wherein the tone includes a carrier for the optical signal.

12. The optical communications system of claim 1 wherein the tone includes a pilot tone located at a frequency separated from a carrier frequency for the optical signal.

13. The optical communications system of claim 1 wherein the first component includes a difference component.

14. The optical communications system of claim 1 further comprising:

a transmitter for generating the optical signal.

15. The optical communications system of claim 14 wherein the transmitter comprises:

a 1:3 splitting section, for splitting a received optical carrier into three sub-signals;

a first and a second transmission leg, each leg coupled to receive one of the three sub-signals from the 1:3 splitting section, for modulating the received optical carrier with a received information signal;

a third transmission leg, coupled to receive one of the three sub-signals from the 1:3 splitting section, for producing an unmodulated version of the received optical carrier; and

a 3:1 combining section coupled to the first, second and third transmission legs, for combining the modulated optical carrier with the unmodulated optical carrier.

16. A transmitter comprising:

a 1:3 splitting section, for splitting a received optical carrier into three sub-signals;

a first and a second transmission leg, each leg coupled to receive one of the three sub-signals from the 1:3 splitting section, for modulating the received optical carrier with a received information signal;

a third transmission leg, coupled to receive one of the three sub-signals from the 1:3 splitting section, for producing an unmodulated version of the received optical carrier; and

a 3:1 combining section coupled to the first, second and third transmission legs, for combining the modulated optical carrier with the unmodulated optical carrier.

17. The transmitter of claim 16 wherein the third transmission leg includes a control section for controlling an amplitude of the unmodulated optical carrier.

18. The transmitter of claim 16 wherein the third transmission leg includes a control section for controlling a phase of the unmodulated optical carrier.

19. A transmitter comprising:

a combiner for combining a received pilot tone with a received information signal to produce an intermediate signal; and

an optical modulator for modulating a received optical carrier with the intermediate signal.

20. The transmitter of claim 19 wherein the optical modulator includes a Mach-Zender modulator.

21. A method for recovering an information signal from an optical signal containing the information signal, the method comprising:

receiving an optical signal including at least one tone and a first sideband of the information signal;

receiving an optical local oscillator signal at a frequency f_{LO};

detecting the optical signal using heterodyne detection and the optical local oscillator signal to produce an electrical signal which is frequency down-shifted by the amount f_{LO} with respect to the optical signal; and

mixing the first sideband of the electrical signal with one of the tones of the electrical signal to produce a first component containing the information signal.

22. The method of claim 21 wherein the step of detecting the optical signal comprises:

combining the optical local oscillator signal and the optical signal; and

detecting the combined optical local oscillator signal and optical signal using square law detection.

23. The method of claim 22 wherein the step of detecting the optical signal further comprises:

matching a polarization of the optical local oscillator signal with a polarization of the optical signal.

24. The method of claim 21 wherein the step of mixing the first sideband of the electrical signal with one of the tones of the electrical signal comprises:

frequency filtering the first sideband and the tone from the electrical signal;

squaring the first sideband and tone to produce the first component; and

frequency filtering the first component.

25. The method of claim 21 wherein the step of mixing the first sideband of the electrical signal with one of the tones of the electrical signal comprises:

frequency filtering the first sideband from the electrical signal;

frequency filtering the tone from the electrical signal;

multiplying the first sideband with the tone to produce the first component; and

frequency filtering the first component.

26. The method of claim 21 wherein:

the optical signal further includes a second sideband of the information signal; and

the method further comprises:

mixing the second sideband of the electrical signal with one of the tones of the electrical signal to produce a second component containing the information signal; and

constructively combining the first and second components to produce a resultant component containing the information signal.

27. The method of claim 26 wherein:

the step of mixing the first sideband of the electrical signal with one of the tones of the electrical signal comprises:

frequency filtering the first sideband and the tone from the electrical signal;

squaring the first sideband and tone to produce the first component; and

frequency filtering the first component; and

the step of mixing the second sideband of the electrical signal with one of the tones of the electrical signal comprises:

frequency filtering the second sideband and the tone from the electrical signal;

squaring the second sideband and tone to produce the second component; and

frequency filtering the second component.

28. The method of claim 26 wherein:

the step of mixing the first sideband of the electrical signal with one of the tones of the electrical signal comprises:

frequency filtering the first sideband from the electrical signal;

frequency filtering the tone from the electrical signal;

multiplying the first sideband with the tone to produce the first component; and

frequency filtering the first component; and

the step of mixing the second sideband of the electrical signal with one of the tones of the electrical signal comprises:

frequency filtering the second sideband from the electrical signal;

frequency filtering the tone from the electrical signal;

multiplying the second sideband with the tone to produce the second component; and

frequency filtering the second component.

29. The method of claim 26 wherein the step of constructively combining the first and second components comprises:

phase-shifting the first component to be in-phase with the second component; and

adding the phase-shifted first component and the second component.

30. The method of claim 21 wherein the tone includes a carrier for the optical signal.

31. The method of claim 30 further comprising:

modulating an optical carrier with the information signal using a raised cosine modulation biased at a V_π point; and

combining the modulated optical carrier with an unmodulated optical carrier to produce the optical signal.

32. The method of claim 30 further comprising:

modulating an optical carrier with the information signal using a raised cosine modulation biased at a point slightly offset from a V_π point to produce the optical signal.

33. The method of claim 21 wherein the tone includes a pilot tone located at a frequency separated from a carrier frequency for the optical signal.

34. The method of claim 33 further comprising:

combining the information signal with a pilot tone; and

modulating an optical carrier with the combined information signal and pilot tone using a raised cosine modulation biased at a V_π point.